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Exercise - I (Conceptual Questions) Build Up Your Understanding

INTRODUCTION

1. The formula weight of H_2SO_4 is 98. The weight of the acid in 400mL of 0.1 M solution is:-
(1) 2.45 g (2) 3.92 g (3) 4.90 g (4) 9.8 g

2. Normality of 2M sulphuric acid is:-
(1) 2 N (2) 4N (3) N/2 (4) N/4

3. If pH = 3.31, then find out $[H^+]$ (Approx)
(1) 3.39×10^{-4} (2) 5×10^{-4}
(3) 3.0×10^{-3} (4) None

4. If $[OH^-] = 5.0 \times 10^{-5}$ M then pH will be :-
(1) 5 - log 5 (2) 9 + log 5
(3) log 5 - 5 (4) log 5 - 9

5. Basicity of H_3PO_3 and H_3PO_2 are respectively:-
(1) 1 and 2 (2) 2 and 3
(3) 3 and 2 (4) 2 and 1

6. Find out pH of solution having 2×10^{-3} moles of OH^- ions in 2 litre solution :-
(1) pH = 3 (2) pH = 3 + log2
(3) pH = 3 – log2 (4) pH = 11

7. pH of tomato juice is 4.4. Then concentration of H_3O^+ will be :-
(1) 39×10^{-4} (2) 3.9×10^{-5}
(3) 3.9×10^{-4} (4) 3.9×10^{5}

8. 8 g NaOH is dissolved in one litre of solution, the molarity of the solution is:-
(1) 0.2 M (2) 0.4 M (3) 0.02 M (4) 0.8 M

9. The amount of acetic acid present in 100 mL of 0.1M solution is :-
(1) 0.30 g (2) 3.0 g (3) 0.60 g (4) None

10. The number of milli equivalents of acid in 100 mL of 0.5N HCl solution is:-
(1) 50 (2) 100 (3) 25 (4) 200

11. If the molar concentration of $MgCl_2$ is 1.5×10^{-3} mol L^{-1}, the concentration of chloride ions in g ion L^{-1} is:-
(1) 3.0×10^{-3} (2) 6.0×10^{-3}
(3) 0.3×10^{-3} (4) 0.6×10^{-6}

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OSTWALD'S DILUTION LAW

12. Degree of dissociation of 0.1 N CH_3COOH is :- (Dissociation constant = 1×10^{-5})
(1) 10^{-5} (2) 10^{-4} (3) 10^{-3} (4) 10^{-2}

13. The degree of dissociation of acetic acid is given by the expression $\alpha = 0.1 \times C^{-1}$ (where C = concentration of the acid) What is the pH of the solution :-
(1) 1 (2) 2 (3) 3 (4) 4

14. Ostwald's dilution law is not applicable for strong electrolytes because:-
(1) Strong electrolytes are completely ionised
(2) Strong electrolytes are volatile
(3) Strong electrolytes are unstable
(4) Strong electrolytes often contain metal ions

15. The degree of ionisation of a compound depends upon :
(1) Size of the solute molecules
(2) Nature of the solute molecules
(3) Nature of the container taken
(4) The amount of current passed

16. Find out K_a for 10^{-2} M HCN acid, having pOH = 10 :-
(1) $K_a = 10^{-4}$ (2) $K_a = 10^{-2}$
(3) $K_a = 10^{-5}$ (4) None of these

17. Which of the following will occur if a 1.0 M solution of a weak acid is diluted to 0.01 M at constant temperature:-
(1) Percentage ionisation will increase
(2) $[H^+]$ will decrease to 0.01M
(3) K_a will increase
(4) pH will decrease by 2 units

18. The extent of ionisation of weak electrolytes increases :-
(1) With the increase in concentration of solute
(2) On decreasing the temp. of solution
(3) On addition of excess of water to the solution
(4) On stirring the solution vigorously

19. If K_a of HCN = 4×10^{-10}, then the pH of 2.5×10^{-1} molar HCN (aq) is:-
(1) 4.2 (2) 4.7 (3) 0.47 (4) 5.0

20. The molarity of nitrous acid solution at which its pH becomes 2.($K_a = 4.5 \times 10^{-4}$) :-
(1) 0.3333 (2) 0.4444
(3) 0.6666 (4) 0.2222

EXPLANATION OF WATER

21. Ionic product of water will increase, if :-
(1) Decrease the pressure
(2) Add H^+
(3) Add OH^-
(4) Increase the temperature

22. For water at 25° C, 2×10^{-7} moles per litre is the correct answer for which one of the following
(1) $[H^+] + [OH^-]$ (2) $[H^+]^2$
(3) $[OH^-]^2$ (4) $[H^+] - [OH^-]$

23. At 25^0C, the dissociation constant for pure water is given by :-
(1) $(55.4 \times 10^{14})^{-1}$ (2) 1×10^{-14}
(3) $\frac{1\ 10^{-14}}{18}$ (4) None of these

24. Ionic product of water is equal to :-
(1) Dissociation constant of water × $[H_2O]$
(2) Dissociation constant of water × $[H^+]$
(3) Product of $[H_2O]$ and $[H^+]$
(4) Product of $[OH^-]^2$ and $[H^+]$

25. For pure water, addition of H^+ and OH^- ion concentrations at 90^0C is :- □
(1) 10^{-14} (2) 10^{-12}
(3) 2×10^{-6} (4) 2×10^{-7}

26. At a certain temperature, pure water has $[H_3O^+] = 10^{-6.7}$ mol L^{-1} .What is the value of K_W at this temperature :-
(1) 10^{-6} (2) 10^{-12}
(3) 10^{-67} (4) $10^{-13.4}$

27. At 373 K, temp. the pH of pure H_2O can be:-
(1) < 7 (2) > 7 (3) = 7 (4) = 0

28. Which of the following is a true statement :
(1) The ionisation constant and ionic product of water are same.
(2) Water is a strong electrolyte.
(3) The value of ionic product of water is less than that of its ionisation constant.
(4) At 298K, the number of H^+ ions in a litre of water is 6.023×10^{16}.

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SALTS, TYPES OF SALT & CONJUGATE THEORY

29. Which of the following is not an acidic salt :-
(1) $NaHSO_4$ (2) HCOONa
(3) NaH_2PO_3 (4) None of these

30. Which is a basic salt :–
(1) $MgCl_2$ (2) KCl
(3) NaCl (4) Mg(OH)Cl

31. The process of neutralisation invariably results in the production of :-
(1) H^+ ions
(2) OH^- ions
(3) Both H^+ and OH^- ions
(4) Molecules of water

32. Which of the following is an acidic salt :-
(1) Na_2S (2) Na_2SO_3
(3) $NaHSO_3$ (4) Na_2SO_4

33. The mixed salt among the following is :-
(1) $\begin{matrix}CH(OH)COONa\\ |\\ CH(OH)COONa\end{matrix}$ (2) $NaKSO_4$
(3) $CaCl_2$ (4) All

HYDROLYSIS OF SALTS

34. At 90^0 C, the pH of 0.1M NaCl aqueous solution is:-
(1) < 7 (2) > 7 (3) 7 (4) 0.1

35. What will be the pH of 1.0 M ammonium formate solution, If $K_a = 1 \times 10^{-4}$ acid $K_b = 1 \times 10^{-5}$:-
(1) 6.5 (2) 7.5 (3) 8.0 (4) 9.0

36. Which salt will not undergo hydrolysis :-
(1) KCl (2) Na_2SO_4 (3) NaCl (4) All

37. $HCOO^- + H_2O \rightleftharpoons HCOOH + OH^-$
Degree of hydrolysis for above reaction is given by:-
(1) $h = \sqrt{K_h}$ (2) $h = \sqrt{\frac{K_h}{C}}$
(3) $h = \sqrt{\frac{K_h}{V}}$ (4) $K_h = \sqrt{hc}$

38. The pH of aqueous solution of sodium acetate is
(1) 7 (2) Very low
(3) > 7 (4) < 7

39. If pK_b for CN^- at 25^oC is 4.7. The pH of 0.5M aqueous NaCN solution is :-
(1) 12 (2) 10 (3) 11.5 (4) 11

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40. The highest pH value is of :-
(1) 0.1 M NaCl
(2) 0.1 M NH_4Cl
(3) 0.1 M CH_3COONa
(4) 0.1 M CH_3COONH_4

41. pH of K_2S solution is:-
(1) 7 (2) Less than 7
(3) More than 7 (4) 0

42. For anionic hydrolysis, pH is given by:-
(1) $pH = \frac{1}{2}pK_W - \frac{1}{2}pK_b - \frac{1}{2}\log C$
(2) $pH = \frac{1}{2}pK_W + \frac{1}{2}pK_a - \frac{1}{2}pK_b$
(3) $pH = \frac{1}{2}pK_W + \frac{1}{2}pK_a + \frac{1}{2}\log C$
(4) None of above

43. Ionisation constant of a weak acid is 10^{-4}. Find out equilibrium constant for the reaction of this weak acid with strong base :-
(1) 10^{-10} (2) 10^{10} (3) 10^{-9} (4) 10^{9}

44. Hydroxyl ion concentration [OH⁻] in the case of sodium acetate can be expressed as (where K_a is dissociation constant of CH_3COOH and C is the concentration of sodium acetate):-
(1) $[OH^-] = (CK_w . K_a)^{1/2}$
(2) $[OH^-] = C.K_w\sqrt{K_a}$
(3) $[OH^-] = \left(\frac{C.K_w}{K_a}\right)^{1/2}$
(4) $[OH^-] = C. K_a. K_w.$

45. Consider :-
(a) $FeCl_3$ in water - Basic
(b) NH_4Cl in water - Acidic
(c) Ammonium acetate in water - Acidic
(d) Na_2CO_3 in water - Basic
Which is/are not correctly matched:-
(1) b and d (2) b only
(3) a and c (4) d only

46. Which of the following salts undergoes hydrolysis in water:-
(1) Na_3PO_4 (2) CH_3COONa
(3) $NaNO_3$ (4) Both (1) and (2)

47. A salt 'X' is dissolved in water of pH = 7. The resulting solution becomes alkaline in nature. The salt is made up of:-
(1) A strong acid and strong base
(2) A strong acid and weak base
(3) A weak acid and weak base
(4) A weak acid and strong base

SOLUBILITY & SOLUBILITY PRODUCT (K_{SP})

48. The solubility product of sparingly soluble Uni- univalent salt (AB type) is defined as the product of ionic concentration in a:-
(1) 1 M solution
(2) Concentration solution
(3) Very dilute solution
(4) Saturated solution

49. If solubility of salts M_2X, QY_2 and PZ_2 are equal, then the relation between their K_{sp} will be :-
(1) $K_{sp}(M_2X) > K_{sp}(QY_2) > K_{sp}(PZ_2)$
(2) $K_{sp}(M_2X) = K_{sp}(QY_2) < K_{sp}(PZ_2)$
(3) $K_{sp}(M_2X) > K_{sp}(QY_2) = K_{sp}(PZ_2)$
(4) $K_{sp}(M_2X) = K_{sp}(QY_2) = K_{sp}(PZ_2)$

50. The expression of solubility product of mercurous iodide is :-
(1) $[2\ Hg^+]^2 \times 2\ [I^-]^2$ (2) $[Hg^{++}]^2 \times [\ 2I^-]^2$
(3) $[\ Hg_2^{2+}\ ] \times [I^-]^2$ (4) $[Hg^{2+}]^2 \times [I^-]^2$

51. At 25°C, the K_{sp} value of AgCl is 1.8×10^{-10}. If 10^{-5} moles of Ag^+ are added to solution then K_{sp} will be :-
(1) 1.8×10^{-15} (2) 1.8×10^{-10}
(3) 1.8×10^{-5} (4) $18 \times 10^{+10}$

52. At 25°C, the volume of water required to dissolve 1g $BaSO_4$ ($K_{sp} = 1.0 \times 10^{-10}$) will be (Molecular weight of $BaSO_4$ = 233) :-
(1) 820 L. (2) 1 L. (3) 205 L. (4) 430 L.

53. Concentration of Ag^+ ions in saturated solution of Ag_2CrO_4 at 20°C is 1.5×10^{-4} mol L^{-1}. At 20°C, the solubility product of Ag_2CrO_4 is :-
(1) 3.3750×10^{-12} (2) 1.6875×10^{-10}
(3) 1.68×10^{-12} (4) 1.6875×10^{-11}

54. If the concentration of CrO_4^{2-} ion in a saturated solution of silver chromate will be 2×10^{-4} M, solubility product of silver chromate will be -
(1) 4×10^{-8} (2) 8×10^{-12}
(3) 32×10^{-12} (4) 6×10^{-12}

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55. If the solubility of AgCl (formula mass=143) in water at 25°C is 1.43×10^{-4} g/100 mL of solution then the value of K_{sp} will be :–
(1) 1×10^{-5} (2) 2×10^{-5}
(3) 1×10^{-10} (4) 2×10^{-10}

56. The solubility product of As_2S_3 is given by the expression :-
(1) $K_{sp} = [As^{3+}]\ [S^{-2}]$ (2) $K_{sp} = [As^{3+}]^1\ [S^{-2}]^1$
(3) $K_{sp} = [As^{3+}]^3\ [S^{-2}]^2$ (4) $K_{sp} = [As^{3+}]^2\ [S^{-2}]^3$

57. If the solubility of $PbBr_2$ is 'S' g molecules per litre, considering 100% ionisation its solubility product is :-
(1) $2S^3$ (2) $4S^2$ (3) $4S^3$ (4) $2S^4$

58. If the solubility of lithium sodium hexafluoro aluminate $Li_3Na_3(AlF_6)_2$ is 'S' mol L^{-1}. Its solubility product is equal to :-
(1) S^8 (2) $12\ S^3$
(3) $18S^3$ (4) $2916\ S^8$

59. One litre of saturated solution of $CaCO_3$ is evaporated to dryness, when 7.0 g of residue is left. The solubility product for $CaCO_3$ is:-
(1) 4.9×10^{-3} (2) 4.9×10^{-5}
(3) 4.9×10^{-9} (4) 4.9×10^{-7}

APPLICATION OF SOLUBILITY PRODUCT(K_{SP})

60. Solubility of AgBr will be minimum in :-
(1) Pure water (2) 0.1 M $CaBr_2$
(3) 0.1 M NaBr (4) 0.1 M $AgNO_3$

61. In which of the following, the solution of AgSCN will be unsaturated :-
(1) $[Ag^+]\ [SCN^-] = K_{sp}$ (2) $[Ag^+]\ [SCN^-] < K_{sp}$
(3) $[Ag^+]\ [SCN^-] > K_{sp}$ (4) $[Ag^+]\ [SCN^-]^2 < K_{sp}$

62. If 's' and 'S' are solubility and solubility product of a sparingly soluble binary electrolyte respectively then :–
(1) $s = S$ (2) $s = S^2$
(3) $s = S^{1/2}$ (4) $s = \frac{1S}{2}$

63. The solubility product of CuS , Ag_2S and HgS are 10^{-37}, 10^{-44} and 10^{-54} respectively. The solubility of these sulphides will be in the order
(1) $HgS > Ag_2S > CuS$ (2) $Ag_2S > HgS > CuS$
(3) $CuS > Ag_2S > HgS$ (4) $Ag_2S > CuS > HgS$

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64. If the maximum concentration of $PbCl_2$ in water is 0.01 M at 298 K, its maximum concentration in 0.1 M NaCl will be:-
(1) 4×10^{-3} M (2) 0.4×10^{-4} M
(3) 4×10^{-2} M (4) 4×10^{-4} M

65. M_2SO_4 (M^+ is a monovalent metal ion) has a K_{sp} of 1.2×10^{-5} at 298 K. The maximum concentration of M^+ ion that could be attained in a saturated solution of this solid at 298 K is:-
(1) 3.46×10^{-3} M (2) 2.89×10^{-2} M
(3) 2.8×10^{-3} M (4) 7.0×10^{-3} M

66. Which of the following has maximum solubility
(K_{sp} value is given in brackets) :-
(1) HgS (1.6×10^{-54}) (2) $PbSO_4$ (1.3×10^{-8})
(3) ZnS (7.0×10^{-26}) (4) AgCl (1.7×10^{-10})

67. Maximum soluble is :- (K_{sp} is given)
(1) CuS (8.5×10^{-36}) (2) CdS (3.6×10^{-28})
(3) ZnS (1.2×10^{-28}) (4) MnS (1.4×10^{-10})

68. In which of the following, the solubility of AgCl will be maximum :-
(1) 0.1 M $AgNO_3$ (2) Water
(3) 0.1 M NaCl (4) 0.1 M KCl

69. The solubility product of three sparingly soluble salts are given below :

No.	Formula	Solubility product
1	PQ	4.0×10^{-20}
2	PQ_2	3.2×10^{-14}
3	PQ_3	2.7×10^{-35}

The correct order of decreasing molar solubility is:-
(1) 1, 2, 3 (2) 2, 1, 3
(3) 3, 2, 1 (4) 2, 3, 1

70. The K_{sp} value for $Gd(OH)_3$ is 2.8×10^{-23}. Find the pH of saturated solution of $Gd(OH)_3$:-
(1) 6.08 (2) 5.08 (3) 8.47 (4) 4.08

71. If the solubility product of $AgBrO_3$ and Ag_2SO_4 are 5.5×10^{-5} and 2×10^{-5} respectively, the relationship between their solubilities can be correctly represented as :-
(1) $S_{AgBrO_3} > S_{Ag_2SO_4}$ (2) $S_{AgBrO_3} = S_{Ag_2SO_4}$
(3) $S_{AgBrO_3} < S_{Ag_2SO_4}$ (4) Unpredictable

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72. Solubility product of $Mg(OH)_2$ is 1×10^{-11}. At what pH, precipitation of $Mg(OH)_2$ will begin from
0.1 M Mg^{2+} solution :-
(1) 9 (2) 5 (3) 3 (4) 7

73. A solution, containing 0.01 M Zn^{+2} and 0.01 M Cu^{2+} is saturated by passing H_2S gas. The S^{-2} concentration is 8.1×10^{-21} M, K_{sp} for ZnS and CuS are 3.0×10^{-22} and 8.0×10^{-36} respectively. Which of the following will occur in the solution:-
(1) ZnS will precipitate
(2) CuS will precipitate
(3) Both ZnS and CuS will precipitate
(4) Both Zn^{2+} and Cu^{2+} will remain in the solution

74. What will happen if the pH of the solution of 0.001 M $Mg(NO_3)_2$ solution is adjusted to pH = 9
($K_{sp}Mg(OH)_2 = 8.9 \times 10^{-12}$)
(1) Precipitation will take place
(2) Precipitation will not take place
(3) Solution will be saturated
(4) None of these

75. The solubility product constant K_{sp} of $Mg(OH)_2$ is 9.0×10^{-12}. If a solution is 0.010 M with respect to Mg^{2+} ion, what is the maximum hydroxide ion concentration which could be present without causing the precipitation of $Mg(OH)_2$:-
(1) 1.5×10^{-7} M (2) 3.0×10^{-7} M
(3) 1.5×10^{-5} M (4) 3.0×10^{-5} M

76. When HCl gas is passed through a saturated solution of common salt, pure NaCl is precipitated because:-
(1) The impurities dissolve in HCl
(2) HCl is slightly soluble in water
(3) The ionic product $[Na^+] \times [Cl^-]$ exceeds the solubility product of NaCl
(4) The solubility product of NaCl is lowered by Cl^- from aq. HCl

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FEW IMPORTANT POINTS

77. Two monobasic weak acids have the same moles of H^+ ions. What is the relationship between dissociation constant and dilution:-
(1) $Ka_1V_1 = Ka_2V_2$ (2) $Ka_1V_2 = Ka_2V_1$
(3) $[Ka_1V_1]^{\frac{1}{2}} = Ka_2V_2$ (4) $Ka_1V_1 = [Ka_2V_2]^{\frac{1}{2}}$

78. Two solutions having same concentration of H^+ ions are called:-
(1) Isotonic solutions
(2) Isohydric solutions
(3) Hypotonic solutions
(4) Hypertonic solutions

79. The pH of a 0.1 M formic acid 0.1% dissociated is equal to 4. What will be the pH of another weak monobasic acid (same concentration) which is 1% dissociated
(1) 2 (2) 3 (3) 1 (4) 4

pH

80. pH of water is 7. When any substance Y is dissolved in water then pH becomes 13. Substance Y is a salt of :-
(1) Strong acid and strong base
(2) Weak acid and weak base
(3) Strong acid and weak base
(4) Weak acid and strong base

81. Minimum pH is shown by aqueous solution of:-
(1) 0.1 M $BaCl_2$ (2) 0.1 M $Ba(NO_3)_2$
(3) 0.1 M $BeCl_2$ (4) 0.1 M $Ba(OH)_2$

82. Given :-
(a) 0.005 M H_2SO_4 (b) 0.1 M Na_2SO_4
(c) 10^{-2} M NaOH (d) 0.01 M HCl
Choose the correct code having same pH :-
(1) a, c, d (2) b, d
(3) a, d (4) a, c

83. What is H^+ ion concentration of 5×10^{-3} M H_2CO_3 solution having a 10% dissociation:-
(1) 10^{-3} (2) 10^{-2}
(3) 10^{-1} (4) 5×10^{-2}

84. A metal hydroxide of molecular formula $M(OH)_4$ is 50% ionised. Its 0.0025M solution will have the pH :-
(1) 12 (2) 2
(3) 4 (4) 11.7

85. In the following solutions, the conc. of different acids are given, which mixture of the acid has highest pH :-

(1) $\frac{M}{10}H_2SO_4$, $\frac{M}{20}HNO_3$, $\frac{M}{10}HClO_4$

(2) $\frac{M}{20}H_2SO_4$, $\frac{M}{10}HNO_3$, $\frac{M}{20}HClO_4$

(3) $\frac{M}{20}H_2SO_4$, $\frac{M}{10}HNO_3$, $\frac{M}{40}HClO_4$

(4) $\frac{M}{20}H_2SO_4$, $\frac{M}{5}HNO_3$, $\frac{M}{5}HClO_4$

86. If 100 mL of pH = 3 and 400 mL of pH = 3 solutions are mixed, what will be the final pH of mixture

(1) 3.2 (2) 3.0 (3) 3.5 (4) 2.8

87. 10^{-6} M HCl is diluted 100 times. Its pH is :-

(1) 6.0 (2) 8.0 (3) 6.95 (4) 9.5

88. pH of 0.001M acetic acid would be :-

(1) 2 (2) > 3 (3) 7 (4) 14

89. At 90°C, the pH of 0.001M KOH solution will be

(1) 3 (2) 11 (3) 5 (4) 9

90. The pH of solution is increased from 3 to 6. Its H^+ ion concentration will be :-

(1) Reduced to half

(2) Doubled

(3) Reduced by 1000 times

(4) Increased by 1000 times

91. A solution has pOH equal to 13 at 298 K. The solution will be:-

(1) Highly acidic (2) Highly basic

(3) Moderately basic (4) Unpredictable

92. The pH of the solution containing 10 mL of a 0.1M NaOH and 10 mL of 0.05M H_2SO_4 would be

(1) Zero (2) 1 (3) >7 (4) 7

93. In a solution of pH = 5, more acid is added in order to reduce the pH upto 2. The increase in hydrogen ion concentration is:-

(1) 100 times (2) 1000 times

(3) 3 times (4) 5 times

94. The hydrogen ion concentration in a given solution is 6×10^{-4} M. Its pH will be :-

(1) 6 (2) 3.22 (3) 4 (4) 2.

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95. The pOH of a solution is 10.0. The hydrogen ion concentration will be :–

(a) 10^{-10} (b) $\frac{Kw}{10^{-10}}$ (c) $\frac{Kw}{10^{-8}}$ (d) 10^{-4}

(1) a, d (2) b, c (3) a, b, c (4) None

96. An aqueous solution whose pH = 0 is :-

(1) Basic (2) Acidic

(3) Neutral (4) Amphoteric

97. Following five solution of KOH were prepare as–

First → 0.1 moles in 1 L

Second → 0.2 moles in 2 L

Third → 0.3 moles in 3 L

Fourth → 0.4 moles in 4 L

Fifth → 0.5 moles in 5 L

The pH of resultant solution is :–

(1) 2 (2) 1 (3) 13 (4) 7

98. The pH of a 0.02 M ammonia solution which is 5% ionised will be :-

(1) 2 (2) 11 (3) 5 (4) 7

99. For $\frac{N}{10}$ H_2SO_4, pH value is :-

(1) 1 (2) 0.586 (3) 0.856 (4) None

100. An aqueous solution of HCl is 10^{-9} M HCl. The pH of the solution should be:-

(1) 9 (2) Between 6 and 7

(3) 7 (4) Unpredictable

101. How many moles of HCl must be removed from 1 litre of aqueous HCl solution to change its pH from 2 to 3 :-

(1) 1 (2) 0.02 (3) 0.009 (4) 0.01

102. 8 g NaOH and 4.9 g H_2SO_4 are present in one litre of the solution. What is its pH

(1) 1 (2) 13 (3) 12 (4) 2

103. Calculate pH of a solution whose 100 mL contains 0.2 g NaOH dissolved in it :-

(1) 10.699 (2) 11.699 (3) 12.699 (4) 13.699

104. What is the quantity of NaOH present in 250 cc of the solution, so that it gives a pH = 13 :-

(1) 10^{-13} g (2) 10^{-1} g (3) 1.0 g (4) 4.0 g

105. 0.001 mol of the strong electrolyte $M(OH)_2$ has been dissolved to make a 20 mL of its saturated solution. Its pH will be : - [$K_w = 1 \times 10^{-14}$]

(1) 13 (2) 3.3 (3) 11 (4) 9.8

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106. Choose the wrong statement :-
(1) For a neutral solution : $[H^+] = [OH^-] = \sqrt{K_w}$
(2) For an acidic solution :
$[H^+] > \sqrt{K_w}$ & $[OH^-] < \sqrt{K_w}$
(3) For a basic solution :
$[H^+] < \sqrt{K_w}$ & $[OH^-] > \sqrt{K_w}$
(4) For a neutral solution :
$[H^+] = [OH^-] = 10^{-7}$ M (at all temperatures)

107. The pH of 0.1 M solution of the following salts increases in order :-
(1) NaCl < NH_4Cl < NaCN < HCl
(2) NaCN < NH_4Cl < NaCl < HCl
(3) HCl < NaCl < NaCN < NH_4Cl
(4) HCl < NH_4Cl < NaCl < NaCN

BUFFER SOLUTIONS AND INDICATOR

108. In a buffer solution the ratio of concentration of NH_4Cl and NH_4OH is 1 : 1. When it changes to 2 : 1, pH of buffer :-
(1) Increases (2) Decreases
(3) No effect (4) None of these

109. To 50 mL of 0.05M formic acid, how much volume of 0.10M sodium formate must be added to get a buffer solution of pH = 4.0 ? (pK_a of the acid is 3.8)
(1) 50 mL (2) 4 mL
(3) 39.6 mL (4) 100 mL

110. In the volumetric estimation of HCl, if we make use of phenolphthalein as an indicator, which base is unsuitable for the titration :-
(1) NaOH (2) RbOH
(3) KOH (4) NH_4OH

111. In a mixture of weak acid and its salt, the ratio of concentration of acid to salt is increased ten-fold. The pH of the solution :-
(1) Decreases by one
(2) Increases by one-tenth
(3) Increases by one
(4) Increases ten-fold

112. pK_b for NH_4OH at certain temperature is 4.74. The pH of basic buffer containing equimolar concentration of NH_4OH and NH_4Cl will be:-
(1) 7.74 (2) 4.74 (3) 2.37 (4) 9.26

113. What is the suitable indicator for titration of NaOH and oxalic acid:-
(1) Methyl orange (2) Methyl red
(3) Phenolphthalein (4) Starch solution

114. Phenolphthalein does not act as an indicator for the titration between :-
(1) KOH and H_2SO_4
(2) NaOH and CH_3COOH
(3) Oxalic acid and $KMnO_4$
(4) $Ba(OH)_2$ and HCl

115. Which can act as buffer :-
(1) NH_4OH + NaOH
(2) HCOOH + CH_3COONa
(3) 40 mL 0.1 M NaCN + 20 mL of 0.1 M HCl
(4) None of them

116. The buffer solution play an important role in:-
(1) Increasing the pH value
(2) Decreasing the pH value
(3) Keeping the pH constant
(4) Solution will be neutral

117. K_a for HCN is 5×10^{-10} at 25^0C. For maintaining a constant pH of 9, the volume of 5M KCN solution required to be added to 10mL of 2M HCN solution is-
(1) 4 mL (2) 7.95 mL
(3) 2 mL (4) 9.3 mL

118. Buffering action of a mixture of CH_3COOH and CH_3COONa is maximum when the ratio of salt to acid is equal to -
(1) 1.0 (2) 100.0 (3) 10.0 (4) 0.1

119 The pink colour of phenolphthalein in alkaline medium is due to -
(1) Negative ion (2) Positive ion
(3) OH^- ions (4) Neutral form

120. Which indicator works in the pH range 8 – 9.8
(1) Phenolphthalein (2) Methyl orange
(3) Methyl red (4) Litmus

121. A basic buffer will obey the equation pOH – pK_b = 1 only under condition:-
(1) [Conjugate acid] : [base] = 1 : 10
(2) [Conjugate acid] = [base]
(3) [Conjugate acid] : [base] = 10 : 1
(4) None of these

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122. For weak acid-strong base titration, the indicator used is :-
(1) Potassium dichromate
(2) Methyl orange
(3) Litmus
(4) Phenolphthalein

123. For which of the following titration, methyl orange is a best indicator :-
(1) $CH_3COOH + NaOH$
(2) $H_2C_2O_4 + NaOH$
(3) $HCl + NaOH$
(4) $CH_3COOH + NH_4OH$

124. The total number of different kind of buffers obtained during the titration of H_3PO_4 with NaOH are :-
(1) 3 (2) 1 (3) 2 (4) 0

125. A certain acidic buffer solution contains equal concentration of X^- and HX. The K_b for X^- is 10^{-10}. The pH of the buffer is :-
(1) 4 (2) 7 (3) 10 (4) 14

126. When 1.0 mL of dil. HCl acid is added to 100 mL of a buffer solution of pH 4.0. The pH of the solution
(1) Becomes 7 (2) Does not change
(3) Becomes 2 (4) Becomes 10

127. The pH of blood is maintained by CO_2 and H_2CO_3 in the body and chemical constituents of blood. This phenomenon is called :-
(1) Colloidal (2) Buffer action
(3) Acidity (4) Salt balance

128. Phenolphthalein is not a good indicator for titrating
(1) NaOH against oxalic acid
(2) NaOH against HCl
(3) NaOH against H_2SO_4
(4) HCl against NH_4OH

129. Which of the following solutions does not act as buffer :–
(1) $H_3PO_4 + NaH_2PO_4$
(2) $NaHCO_3 + H_2CO_3$
(3) $NH_4Cl + HCl$
(4) $CH_3COOH + CH_3COONa$

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130. On addition of NaOH to CH_3COOH solution, 60% of the acid is neutralised. If pK_a of CH_3COOH is 4.7 then the pH of the resulting solution is :-
(1) More than 4.7 but less than 5.0
(2) Less than 4.7 but more than 4.0
(3) More than 5.0
(4) Remains unchanged

131. 500 mL of 0.2 M acetic acid are added to 500 mL of 0.30 M sodium acetate solution. If the dissociation constant of acetic acid is 1.5×10^{-5} then pH of the resulting solution is:-
(1) 5.0 (2) 9.0 (3) 3.0 (4) 4.0

132. Half of the formic acid solution is neutralised on addition of a KOH solution to it. If K_a (HCOOH) = 2×10^{-4} then pH of the solution is : (log 2 = 0.3010)
(1) 3.6990 (2) 10.3010
(3) 3.85 (4) 4.3010

133. A solution contains 0.2M NH_4OH and 0.2M NH_4Cl. If 1.0 mL of 0.001 M HCl is added to it. What will be the $[OH^-]$ of the resulting solution
$[K_b = 2 \times 10^{-5}]$:-
(1) 2×10^{-5} (2) 5×10^{-10}
(3) 2×10^{-3} (4) None of these

134. Henderson equation $pH - pK_a = 1$ will be applicable to an acidic buffer when :-
(1) [Acid] = [Conjugate base]
(2) [Acid] × 10 = [Conjugate base]
(3) [Acid] = [Conjugate base] × 10
(4) None of these

135. 0.05 M ammonium hydroxide solution is dissolved in 0.001 M ammonium chloride solution. What will be the OH^- ion concentration of this solution: $K_b(NH_4OH) = 1.8 \times 10^{-5}$
(1) 3.0×10^{-3} (2) 9.0×10^{-4}
(3) 9.0×10^{-3} (4) 3.0×10^{-4}

136. When 0.02 moles of NaOH are added to a litre of buffer solution, its pH changes from 5.75 to 5.80. What is its buffer capacity :-
(1) 0.4 (2) 0.05 (3) –0.05 (4) 2.5

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137. Calculate the pH of a buffer prepared by mixing 300 cc of 0.3 M NH_3 and 500 cc of 0.5 M NH_4Cl. K_b for $NH_3 = 1.8 \times 10^{-5}$:-
(1) 8.1187 (2) 9.8117
(3) 8.8117 (4) None of these

138. Calculate the ratio of pH of a solution containing 1 mole of CH_3COONa + 1 mole of HCl per litre and of other solution containing 1 mole CH_3COONa + 1mole of acetic acid per litre :-
(1) 1 : 1 (2) 2 : 1 (3) 1 : 2 (4) 2 : 3

139. When 20 mL of $\frac{M}{20}$ NaOH are added to 10 mL of $\frac{M}{10}$ HCl, the resulting solution will:-
(1) Turn blue litmus red
(2) Turn phenolphthalein solution
(3) Turn methyl orange red
(4) Will have no effect on either red or blue litmus

140. 10 mL of a solution contains 0.1 M NH_4Cl + 0.01 M NH_4OH. Which addition would not change the pH of solution :–
(1) Adding 1 mL water
(2) Adding 5 mL of 0.1 M NH_4Cl
(3) Adding 5 mL of 0.1 M NH_4OH
(4) Adding 10 mL of 0.1 M NH_4Cl

141. $\frac{N}{10}$ acetic acid was titrated with $\frac{N}{10}$ NaOH. When 25%, 50% and 75% of titration is over then the pH of solution will be :- [$K_a = 10^{-5}$]
(1) 5 + log 1/3, 5, 5 + log 3
(2) 5 + log 3, 4, 5 + log 1/3
(3) 5 – log 1/3, 5, 5 – log 3
(4) 5 – log 1/3, 4, 5 + log 1/3

ACID AND BASE

142. The conjugate acid of O^{-2} is :-
(1) O_2^+ (2) H^+ (3) H_3O^+ (4) OH^-

143. Ionization constant of AOH and BOH base are K_{b_1} and K_{b_2}. Their relation is $pK_{b_1} < pK_{b_2}$. Conjugate of following base, does not show maximum pH :
(1) AOH (2) BOH
(3) Both of them (4) None of these

144. Select the species which can function as lewis base, bronsted acid and bronsted base:-
(a) H_2O (b) NH_4^+ (c) N^{-3}
Correct code is :-
(1) Only a (2) a, b (3) a, c (4) b, c

145. Which ion does not show acid behaviour :-
(1) $\left[Al(H_2O)_6\right]^{+3}$ (2) $\left[Fe(H_2O)_6\right]^{+3}$
(3) HPO_4^{-2} (4) ClO_3^-

146. An example of Lewis acid is:-
(1) CaO (2) CH_3NH_2
(3) SO_3 (4) None of these

147. In the reaction $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$ water behaves as :-
(1) Acid (2) Base
(3) Neutral (4) Both acid & Base

148. Which acts as Lewis base in the reaction
$BCl_3 + :PH_3 \rightarrow Cl_3B \leftarrow PH_3$
(1) PH_3 (2) BCl_3
(3) Both 1 & 2 (4) None

149. Which acts as Lewis acid in the reaction
$SnCl_2 + 2Cl^- \longrightarrow [SnCl_4]^{-2}$
(1) Cl^- (2) $SnCl_2$ (3) $SnCl_4$ (4) None

150. The conjugate base of $(CH_3)_2\overset{+}{N}H_2$ is :-
(1) CH_3NH_2 (2) $(CH_3)_2N^+$
(3) $(CH_3)_2N$ (4) $(CH_3)_2NH$

151. Which equilibrium can be described as Lewis acid base reaction but not Bronsted acid base reaction:-
(1) $H_2O + CH_3COOH \rightleftharpoons H_3O^+ + CH_3COO^-$
(2) $2NH_3 + H_2SO_4 \rightleftharpoons 2NH_4^+ + SO_4^{2-}$
(3) $NH_3 + CH_3COOH \rightleftharpoons NH_4^+ + CH_3COO^-$
(4) $Cu^{+2} + 4NH_3 \rightleftharpoons [Cu(NH_3)_4]^{2+}$

152. Conjugate base of hydrazoic acid is :-
(1) HN_3^- (2) N_3^- (3) N^{3-} (4) N_2^-

153. NH_3 gas dissolves in water to give NH_4OH, in this reaction, water acts as :-
(1) An acid (2) A base
(3) A salt (4) A conjugate base

154. When ammonia is added to water, it decreases the concentration of which of the following ion
(1) OH^- (2) H_3O^+ (3) NH^+_4 (4) None

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155. The strongest acid among the following is -
(1) $ClO_3(OH)$ (2) $ClO_2(OH)$
(3) $SO(OH)_2$ (4) $SO_2(OH)_2$

156. Which of the following is not a Bronsted acid:-
(1) $CH_3NH_4^+$ (2) CH_3COO^-
(3) H_2O (4) HSO_4^-

157. Which of the following example behave as a Lewis acid BF_3, $SnCl_2$, $SnCl_4$:-
(1) $SnCl_2$, $SnCl_4$ (2) BF_3, $SnCl_2$
(3) Only BF_3 (4) BF_3, $SnCl_2$, $SnCl_4$

158. In the reaction

$HNO_3 + H_2O \rightleftharpoons H_3O^+ + NO_3^-$, the conjugate base of HNO_3 is :-
(1) H_2O (2) H_3O^+
(3) NO_3^- (4) H_3O^+ and NO_3^-

159. The conjugate base of the weak acid in the reaction $HBr + H_2O \rightleftharpoons H_3O^+ + Br^-$ is
(1) HBr (2) H_2O (3) Br^- (4) H_3O^+

160. In the reaction, $AlCl_3 + Cl^- \rightarrow [AlCl_4]^-$, $AlCl_3$ acts as :-
(1) Salt (2) Lewis base
(3) Bronsted acid (4) Lewis acid

161. Mg^{2+} is _____ than Al^{3+} :-
(1) Stronger Lewis acid
(2) Stronger Lewis base
(3) Weaker Lewis acid
(4) Weaker Lewis base

162. The two Bronsted bases in the reaction

$HC_2O_4^- + PO_4^{3-} \rightleftharpoons HPO_4^{2-} + C_2O_4^{2-}$ are
(1) $HC_2O_4^-$ and PO_4^{2-} (2) HPO_4^{2-} and $C_2O_4^{2-}$
(3) PO_4^{3-} and $C_2O_4^{-2}$ (4) $HC_2O_4^-$ and HPO_4^{2-}

163. The compound HCl behaves as ---- in the reaction, $HCl + HF \rightleftharpoons H_2^+Cl + F^-$
(1) Strong acid (2) Strong base
(3) Weak acid (4) Weak base

164. Which of the following is not a lewis base:-
(1) NH_3 (2) O^{2-} (3) H_2O (4) I^+

165. Which of the following is Bronsted Lowry acid:-
(1) SO_4^{-2} (2) H_3O^+ (3) OH^- (4) Cl^-

166. The conjugate base for bicarbonate ion is:-
(1) CO_3^{2-} (2) HCO_3^-
(3) CO_2 (4) H_2CO_3

167. HCl does not behave as acid in :-
(1) NH_3 (2) C_2H_5OH
(3) H_2O (4) C_6H_6

168. Which of the following is a base according to Bronsted-Lowry concept :-
(1) I^- (2) H_3O^+ (3) HCl (4) NH_4^+

169. In which of the following reactions NH_3 acts as acid
(1) $NH_3 + HCl \rightarrow NH_4Cl$
(2) $NH_3 + H^+ \rightarrow NH_4^+$
(3) $NH_3 + Na \rightarrow NaNH_2 + \frac{1}{2} H_2$
(4) NH_3 cannot act as acid

170. According to Bronsted concept, the acids in the following reaction $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$ are :-
(1) NH_3 and NH_4^+ (2) H_2O and OH^-
(3) H_2O and NH_4^+ (4) NH_3 and OH^-

171. CH_3COO^- ion is a :-
(1) Weak conjugate base
(2) Strong conjugate base
(3) Weak conjugate acid
(4) Strong conjugate acid

172. Which of the following is strongest conjugate base
(1) ClO_4^- (2) HCO_3^- (3) Cl^- (4) HSO_4^-

173. Which of the following species can act as Lewis base :-
(1) Cu^{2+} (2) $AlCl_3$ (3) NH_3 (4) BF_3

174. A compound having the formula NH_2CH_2COOH may behave :-
(1) Only as an acid
(2) Only as a base
(3) Both as an acid and base
(4) Neither acid nor base

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175. Which of the following can act both as Bronsted acid and Bronsted base :-
(1) Na_2CO_3 (2) O^{2-}
(3) CO_3^{-2} (4) NH_3

176. The strongest conjugate base is :-
(1) NO_3^- (2) Cl^-
(3) SO_4^{2-} (4) CH_3COO^-

177. Aluminium chloride is :-
(1) Bronsted Lowry acid
(2) Arrhenius acid
(3) Lewis acid
(4) Lewis base

178. Water is a :-
(1) Protogenic solvent
(2) Protophilic solvent
(3) Amphiprotic solvent
(4) Aprotic solvent

179. Ammonium ion is :-
(1) A conjugate acid
(2) A conjugate base
(3) Neither an acid nor a base
(4) Both an acid and a base

180. Species which do not act both as Bronsted acid and base is :-
(1) $(HSO_4)^{-1}$ (2) Na_2CO_3
(3) NH_3 (4) OH^{-1}

181. Which one of the following is strong Lewis base & Bronsted acid & bronsted base:-
(1) NH_3 (2) PH_3
(3) CH_4 (4) BH_3

182. Which of the following is not a correct statement
(1) Arrhenius theory of acids-bases is capable of explaining the acidic or basic nature of the substances in the solvents other than water
(2) Arrhenius theory does not explain acidic nature of $AlCl_3$
(3) The aqueous solution of Na_2CO_3 is alkaline although it does not contain OH^- ions
(4) Aqueous solution of CO_2 is acidic although it does not contain H^+ ions

183. For the reaction $NH_4^+ + S^{-2} \rightleftharpoons NH_3 + HS^-$,$NH_3$ and S^{-2} are a group of :-
(1) Acids (2) Bases
(3) Acid-base pair (4) None of these

184. According to Arrhenius theory, acids are substances that dissociate in water to give ...(X) ... ions and bases are substances that produce ...(Y).... ions. Here, (X) and (Y) refer to
(1) Hydronium, Hydroxyl
(2) Hydroxyl, Hydrogen
(3) Hydrogen, Hydroxyl
(4) Hydroxyl, Hydronium

185. 'An acid is substance that is capable of donating a proton (H^+) and base is a substance capable of accepting a proton (H^+). The above statement is justified by
(1) Arrhenius concept
(2) Bronsted-Lowry theory
(3) Lewis concept
(4) All of these

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EXERCISE-I (Conceptual Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	2	2	2	4	4	2	1	3	1	1	4	1	1	2
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	4	1	3	4	4	4	1	1	1	3	4	1	4	2	4
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	4	3	2	1	1	4	2	3	3	3	3	3	2	3	3
Question	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	4	4	4	4	3	2	4	3	3	3	4	3	4	1	2
Question	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Answer	2	3	4	4	2	2	4	2	4	3	3	1	2	2	4
Question	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Answer	3	2	2	2	4	3	3	1	4	3	2	3	2	4	3
Question	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
Answer	1	4	2	2	4	2	3	2	1	2	3	2	3	3	1
Question	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Answer	4	4	2	3	4	1	4	3	3	3	3	3	1	1	1
Question	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
Answer	3	4	3	1	1	2	2	4	3	1	1	1	1	2	2
Question	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
Answer	1	3	3	4	1	1	4	2	1	4	3	1	1	2	4
Question	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
Answer	4	2	1	2	1	2	4	3	2	4	3	3	4	4	2
Question	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
Answer	1	4	1	3	3	2	2	3	3	4	4	3	3	1	2
Question	181	182	183	184	185										
Answer	1	1	2	3	2										

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Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT 2009

1. The ionization constant of ammonium hydroxide is 1.77×10^{-5} at 298 K. Hydrolysis constant of ammonium chloride is :-
(1) 5.65×10^{-12} (2) 5.65×10^{-10}
(3) 6.50×10^{-12} (4) 5.65×10^{-13}

2. What is the $[OH^-]$ in the final solution prepared by mixing 20.0 mL of 0.050 M HCl with 30.0 mL of 0.10M $Ba(OH)_2$?
(1) 0.12 M (2) 0.10 M
(3) 0.40 M (4) 0.0050M

3. The dissociation constants for acetic acid and HCN at 25°C are 1.5×10^{-5} and 4.5×10^{-10}, respectively. The equilibrium constant for the equilibrium
$CN^- + CH_3COOH \rightleftharpoons HCN + CH_3COO^-$
would be :-
(1) 3.3×10^4 (2) 3.0×10^5
(3) 3.3×10^{-5} (4) 3.0×10^{-4}

AIPMT 2010

4. If pH of a saturated solution of $Ba(OH)_2$ is 12, the value of its K_{sp} is :-
(1) $5.00 \times 10^{-7}\ M^3$ (2) $4.00 \times 10^{-6}\ M^3$
(3) $4.00 \times 10^{-7}\ M^3$ (4) $5.00 \times 10^{-6}\ M^3$

5. Find the pH of a buffer solution containing equal concentration of B^- and HB. (K_b for B^- is 10^{-10}) :-
(1) 4 (2) 10 (3) 7 (4) 6

AIPMT Mains 2011

6. In qualitative analysis, the metals of Group I can be separated from other ions by precipitating them as chloride salts. A solution initially contains Ag^+ and Pb^{2+} at a concentration of 0.10 M. Aqueous HCl is added to this solution until the Cl^- concentration is 0.10 M. What will the concentrations of Ag^+ and Pb^{2+} be at equilibrium?
(K_{sp} for AgCl=1.8×10^{-10}, K_{sp} for $PbCl_2$=1.7×10^{-5})
(1) $[Ag^+] = 1.8 \times 10^{-11}$ M ; $[Pb^{2+}] = 1.7 \times 10^{-4}$ M;
(2) $[Ag^+] = 1.8 \times 10^{-7}$ M ; $[Pb^{2+}] = 1.7 \times 10^{-6}$ M;
(3) $[Ag^+] = 1.8 \times 10^{-11}$ M ; $[Pb^{2+}] = 8.5 \times 10^{-5}$ M;
(4) $[Ag^+] = 1.8 \times 10^{-9}$ M ; $[Pb^{2+}] = 1.7 \times 10^{-3}$ M;

7. A buffer solution is prepared in which the concentration of NH_3 is 0.30 M and the concentration of NH_4^+ is 0.20 M. If the equilibrium constant, K_b for NH_3 equals 1.8×10^{-5}, what is the pH of this solution ? (log 2.7 = 0.43)
(1) 9.08 (2) 9.43 (3) 11.72 (4) 8.73

AIPMT Mains 2012

8. Buffer solutions have constant acidity and alkalinity because:
(1) They have large excess of H^+ or OH^- ions
(2) They have fixed value of pH
(3) These give unionised acid or base on reaction with added acid or alkali
(4) Acids and alkalies in these solutions are shielded from attack by other ions

9. Equimolar solutions of the following substances were prepared separately. Which one of the these will record the highest pH value?
(1) LiCl (2) $BeCl_2$ (3) $BaCl_2$ (4) $AlCl_3$

NEET UG 2013

10. Which is the strongest acid in the following ?
(1) H_2SO_3 (2) H_2SO_4
(3) $HClO_3$ (4) $HClO_4$

AIPMT 2014

11. Which of the following salts will give highest pH in water ?
(1) KCl (2) NaCl
(3) Na_2CO_3 (4) $CuSO_4$

AIPMT 2015

12. The K_{sp} of Ag_2CrO_4, AgCl, AgBr and AgI are respectively, 1.1×10^{-12}, 1.8×10^{-10}, 5.0×10^{-13}, 8.3×10^{-17}. Which one of the following salts will precipitate last if $AgNO_3$ solution is added to the solution containing equal moles of NaCl, NaBr, NaI and Na_2CrO_4 ?
(1) AgCl (2) AgBr
(3) Ag_2CrO_4 (4) AgI

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Re-AIPMT 2015

13. Which one of the following pairs of solution is not an acidic buffer ?

(1) H_2CO_3 and Na_2CO_3

(2) H_3PO_4 and Na_3PO_4

(3) $HClO_4$ and $NaClO_4$

(4) CH_3COOH and CH_3COONa

14. What is the pH of the resulting solution when equal volumes of 0.1 M NaOH and 0.01 M HCl are mixed?

(1) 7.0 (2) 1.04 (3) 12.65 (4) 2.0

NEET-I 2016

15. MY and NY_3, two nearly insoluble salts, have the same K_{sp} values of 6.2×10^{-13} at room temperature. Which statement would be **true** in regard to MY and NY_3 ?

(1) The molar solubilities of MY and NY_3 in water are identical.

(2) The molar solubility of MY in water is less than that of NY_3

(3) The salts MY and NY_3 are more soluble in 0.5 M KY than in pure water.

(4) The addition of the salt of KY to solution of MY and NY_3 will have no effect on their solubilities.

NEET-II 2016

16. The percentage of pyridine (C_5H_5N) that forms pyridinium ion ($C_5H_5N^+H$) in a 0.10 M aqueous pyridine solution (K_b for $C_5H_5N = 1.7 \times 10^{-9}$) is

(1) 0.77% (2) 1.6%

(3) 0.0060% (4) 0.013%

17. The solubility of AgCl(s) with solubility product 1.6×10^{-10} in 0.1 M NaCl solution would be

(1) 1.6×10^{-11} M (2) zero

(3) 1.26×10^{-5} M (4) 1.6×10^{-9} M

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NEET(UG) 2017

18. Concentration of the Ag^+ ions in a saturated solution of $Ag_2C_2O_4$ is 2.2×10^{-4} mol L^{-1} Solubility product of $Ag_2C_2O_4$ is :-

(1) 2.66×10^{-12} (2) 4.5×10^{-11}

(3) 5.3×10^{-12} (4) 2.42×10^{-8}

NEET(UG) 2018

19. Following solutions were prepared by mixing different volumes of NaOH and HCl of different concentrations :

a. $60mL\,\frac{M}{10}HCl + 40mL\,\frac{M}{10}NaOH$

b. $55mL\,\frac{M}{10}HCl + 45mL\,\frac{M}{10}NaOH$

c. $75mL\,\frac{M}{5}HCl + 25mL\,\frac{M}{5}NaOH$

d. $100mL\,\frac{M}{10}HCl + 100mL\,\frac{M}{10}NaOH$

pH of which one of them will be equal to 1 ?

(1) b (2) a (3) d (4) c

20. The solubility of $BaSO_4$ in water 2.42×10^{-3} gL^{-1} at 298 K. The value of solubility product (K_{sp}) will be (Given molar mass of $BaSO_4$ = 233 g mol^{-1})

(1) 1.08×10^{-10} mol^2 L^{-2}

(2) 1.08×10^{-12} mol^2 L^{-2}

(3) 1.08×10^{-14} mol^2 L^{-2}

(4) 1.08×10^{-8} mol^2 L^{-2}

NEET(UG) 2019

21. pH of a saturated solution of $Ca(OH)_2$ is 9. The solubility product (K_{sp}) of $Ca(OH)_2$ is :-

(1) 0.5×10^{-15} (2) 0.25×10^{-10}

(3) 0.125×10^{-15} (4) 0.5×10^{-10}

22. Which will make basic buffer ?

(1) 50 mL of 0.1 M NaOH + 25 mL of 0.1 M CH_3COOH

(2) 100 mL of 0.1 M CH_3COOH + 100 mL of 0.1M NaOH

(3) 100 mL of 0.1 M HCl + 200 mL of 0.1 M NH_4OH

(4) 100 mL of 0.1 M HCl + 100 mL of 0.1 M NaOH

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NEET(UG) (Odisha) 2019

23. The pH of 0.01 M NaOH (aq) solution will be
(1) 7.01 (2) 2 (3) 12 (4) 9

24. Which of the following cannot act both as Bronsted acid and as Bronsted base ?
(1) HCO_3^- (2) NH_3 (3) HCl (4) HSO_4^-

25. The molar solubility of CaF_2 ($K_{sp} = 5.3 \times 10^{-11}$) in 0.1 M solution of NaF will be
(1) 5.3×10^{-11} mol L^{-1} (2) 5.3×10^{-8} mol L^{-1}
(3) 5.3×10^{-9} mol L^{-1} (4) 5.3×10^{-10} mol L^{-1}

NEET (UG) 2020

26. Find out the solubility of $Ni(OH)_2$ in 0.1M NaOH. Given that the ionic product of $Ni(OH)_2$ is 2×10^{-15}.
(1) 1×10^8 M (2) 2×10^{-13} M
(3) 2×10^{-8} M (4) 1×10^{-13} M

NEET (UG) 2020 (COVID-19)

27. Which among the following salt solutions is basic in nature ?
(1) Ammonium chloride
(2) Ammonium sulphate
(3) Ammonium nitrate
(4) Sodium acetate

28. The solubility product for a salt of the type AB is 4×10^{-8}. What is the molarity of its standard solution?
(1) 2×10^{-4} mol/L (2) 16×10^{-16} mol/L
(3) 2×10^{-16} mol/L (4) 4×10^{-4} mol/L

NEET (UG) 2021

29. The pK_b of dimethylamine and pK_a of acetic acid are 3.27 and 4.77 respectively at T (K). The correct option for the pH of dimethylammonium acetate solution is:
(1) 8.50 (2) 5.50
(3) 7.75 (4) 6.25

NEET (UG) 2022

30. The pH of the solution containing 50 mL each of 0.10 M sodium acetate and 0.01 M acetic acid is [Given pK_a of CH_3COOH = 4.57]
(1) 3.57 (2) 4.57
(3) 2.57 (4) 5.57

31. 0.01 M acetic acid solution is 1% ionised, then pH of this acetic acid solution is :
(1) 3 (2) 2 (3) 4 (4)1

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	2	1	1	1	4	2	3	3	4	3	3	3	3	2
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	4	4	3	4	1	1	3	3	3	3	2	4	1	3	4
Question	31														
Answer	3														

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Exercise – III (Analytical Questions) Master Your Understanding

1. Given below are two statements:

Statement-I : During hydrolysis of CH_3COONH_4, the ions formed undergo hydrolysis as follow :

$$CH_3COO^- + NH_4^+ + H_2O \rightleftharpoons CH_3COOH + NH_4OH$$

Statement-II : The degree of hydrolysis of CH_3COONH_4 is independent of concentration of solution.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Statement-I & statement-II both are correct

(2) Only statement-I is correct

(3) Only statement-II is correct

(4) Statement-I & statement-II both are incorrect

2. Match the following :

pH calculation for following mixtures can be done on the basis of concept of

	List-I		List-II
(a)	Buffer solution	(i)	50 mL of 0.1 M HCl mixed with 10 mL of 0.2 M HCN.
(b)	Salt hydrolysis	(ii)	200 mL of 0.02 M CH_3COONa mixed with 100 mL 0.02 M CH_3COOH
(c)	Strong acid	(iii)	100 mL of 0.5 M HCl mixed with 500 mL of 0.1 M NH_4OH
(d)	Weak acid	(iv)	100 mL of 0.4 M NaCN mixed with 100 mL of 0.4 M HCl

(1) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)

(2) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

(3) (a)-(iii), (b)-(ii), (c)-(i), (d)-(iv)

(4) (a)-(ii), (b)-(iii), (c)-(i), (d)-(iv)

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3. Given below are two statements:

Statement-I : When NaCl is dissolved in water then electrostatic interactions are reduced by a factor 80.

Statement-II : Dielectric constant of water is 80.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Statement-I and statement-II are incorrect.

(2) Statement-I and statement-II are correct.

(3) Statement-I is incorrect but statement-II is correct.

(4) Statement-I is correct but statement-II is incorrect

4. Arrange the following solutions in the decreasing order of pH :

(A) 0.01 M HCl

(B) 0.01 M NaOH

(C) 0.01 M CH_3COONa

(D) 0.01 M NaCl

(1) (B) > (D) > (C) > (A)

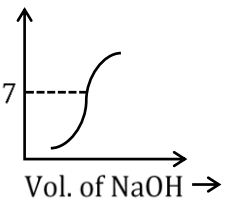
(2) (B) > (C) > (D) > (A)

(3) (A) > (C) < (D) > (B)

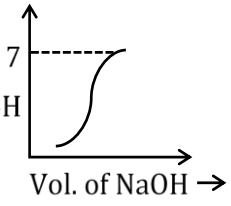
(4) (A) > (D) > (C) > (B)

5. 100 mL of 0.1 M HCl is taken in a beaker and to it 100 mL of 0.1 M NaOH is added in steps of 2 mL and the pH is continuously measured. Which of the following graphs correctly depicts the change in pH?

(1)



(2)



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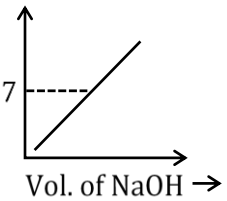
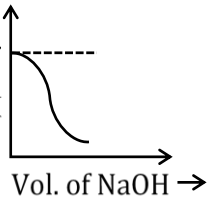
(3)


(4)


6. Given below are two statements:

Statement-I : Solubility of AgBr decreases in the presence of NaBr.

Statement-II : NaBr undergoes hydrolysis in water.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Statement-I and statement-II are incorrect.

(2) Statement-I and statement-II are correct.

(3) Statement-I is incorrect but statement-II is correct.

(4) Statement-I is correct but statement-II is incorrect

7. Statement-I : Acids turn red litmus paper blue.

Statement-II : Acids taste bitter and feel soapy.

(1) Statement-I and statement-II are incorrect.

(2) Statement-I and statement-II are correct.

(3) Statement-I is incorrect but statement-II is correct.

(4) Statement-I is correct but statement-II is incorrect

8. Given below are two statements:

Statement-I : Conjugate acid and conjugate base of NH_3 respectively are NH_4^+ and NH_2^-.

Statement-II : The acid base pair that differs only by one proton is called a conjugate acid base pair.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Statement-I and statement-II are incorrect.

(2) Statement-I and statement-II are correct.

(3) Statement-I is incorrect but statement-II is correct.

(4) Statement-I is correct but statement-II is incorrect

9. Given below are two statements:

Statement-I : The cations of strong bases and anions of strong acids simply get hydrolyse but do not get hydrated.

Statement-II : The solutions of salts formed from strong acids & bases are neutral.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Statement-I and statement-II are incorrect.

(2) Statement-I and statement-II are correct.

(3) Statement-I is incorrect but statement-II is correct.

(4) Statement-I is correct but statement-II is incorrect

10. Given below are two statements; one is labelled as **Assertion (A)** and the other is labelled as **Reason(R)**.

Assertion : Addition of acetate ions to an acetic acid solution results in decreasing the concentration of hydrogen ions.

Reason : Due to common ion effect, the equilibrium moves in the direction of undissociated acetic acid.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(1) (A) is correct but (R) is not correct

(2) Both (A) and (R) are correct and (R) is correct explanation of (A)

(3) Both (A) and (R) are correct but (R) is not correct explanation of (A)

(4) (A) is not correct but (R) is correct

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11. Given below are two statements; one is labelled as **Assertion (A)** and the other is labelled as **Reason(R)** .

Assertion : All Arrhenius acids are Bronsted acids.

Reason : All Bronsted acids are Arrhenius acids.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(1) (A) is correct but (R) is not correct

(2) Both (A) and (R) are correct and (R) is correct explanation of (A)

(3) Both (A) and (R) are correct but (R) is not correct explanation of (A)

(4) (A) is not correct but (R) is correct

12. Match the Column – I and Column - II

	Column-I (Species)		Column-II (Conjugate acid)
(a)	NH_3	(p)	H_2CO_3
(b)	HCO_3^-	(q)	H_2SO_4
(c)	H_2O	(r)	NH_4^+
(d)	HSO_4^-	(s)	H_3O^+

(1) (a) → (r); (b) → (p); (c) → (s); (d) → (q)

(2) (a) → (p); (b) → (r); (c) → (q); (d) → (s)

(3) (a) → (r); (b) → (s); (c) → (p); (d) → (q)

(4) (a) → (q); (b) → (p); (c) → (r); (d) → (s)

13. Match the Column – I and Column - II

	Column-I		Column-II
(a)	$Al(OH)_3$	(p)	$S=\left(\frac{K_{sp}}{6912}\right)^{1/7}$
(b)	$BaCrO_4$	(q)	$S=\left(\frac{K_{sp}}{4}\right)^{1/3}$
(c)	$Zr_3(PO_4)_4$	(r)	$S=\left(\frac{K_{sp}}{27}\right)^{1/4}$
(d)	Hg_2I_2	(s)	$S=(K_{sp})^{1/2}$

(1) (a) → (r); (b) → (s); (c) → (p); (d) → (q)

(2) (a) → (s); (b) → (p); (c) → (r); (d) → (q)

(3) (a) → (p); (b) → (q); (c)→ (s); (d) → (r)

(4) (a) → (q); (b) → (r); (c) → (p); (d) → (s)

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14. If concentrations of two acids are same, their relative strengths can be compared by :

(a) $\frac{\alpha_1}{\alpha_2}$ (b) $\frac{[H^+]_1}{[H^+]_2}$

(c) $\sqrt{\frac{K_1}{K_2}}$ (d) $\frac{K_1}{K_2}$

(1) a, c, d are correct (2) a, b, c are correct

(3) b, c, d are correct (4) All are correct

15. Which can act as a buffer ?

(a) $CH_3COOH + NaOH$; if $[CH_3COOH] > [NaOH]$

(b) $HCl + CH_3COONa$; if $[CH_3COONa] > [HCl]$

(c) $HCl + NaCl$

(d) NH_4CN

(1) a, b, d (2) b, c, d (3) a, c, d (4) c, d

16. Given below are two statements:

Statement-I: For HCN, $pK_a(HCN) + pK_b(CN^-) = pk_w$ at all temperature.

Statement-II : Sum of negative log of ionisation constants of weak acid and of it's conjugate base is equal to 14 at all temperatures.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Statement-I and statement-II are incorrect.

(2) Statement-I and statement-II are correct.

(3) Statement-I is incorrect but statement-II is correct.

(4) Statement-I is correct but statement-II is incorrect

17. Given below are two statements:

Statement-I : pH of a 1.0×10^{-8} M solution of HCl is 8 at 25°C.

Statement-II : HCl is a strong acid and negative log of H^+ concentration is called pH.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Statement-I and statement-II are incorrect.

(2) Statement-I and statement-II are correct.

(3) Statement-I is incorrect but statement-II is correct.

(4) Statement-I is correct but statement-II is incorrect

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18. Given below are two statements; one is labelled as **Assertion (A)** and the other is labelled as **Reason(R)** .

Assertion : Water act as base in the reaction

$HCl\ (aq.) + H_2O(\ell) \rightleftharpoons H_3O^+(aq.) + Cl^-(aq.)$

Reason : According to Bronsted-lowry proton acceptors are known as base.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(1) (A) is correct but (R) is not correct

(2) Both (A) and (R) are correct and (R) is correct explanation of (A)

(3) Both (A) and (R) are correct but (R) is not correct explanation of (A)

(4) (A) is not correct but (R) is correct

19. Given below are two statements; one is labelled as **Assertion (A)** and the other is labelled as **Reason(R)** .

Assertion : pH of NH_4Cl solution in water is less than 7 at 25°C.

Reason : Ammonium hydroxide is a strong base.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(1) (A) is correct but (R) is not correct

(2) Both (A) and (R) are correct and (R) is correct explanation of (A)

(3) Both (A) and (R) are correct but (R) is not correct explanation of (A)

(4) (A) is not correct but (R) is correct

20. Amongs H_2O, HCO_3^-, HSO_4^- and NH_3 the species which can act as Bronsted acid as well as Bronsted bases, are –

(1) H_2O and NH_3

(2) H_2O, HCO_3^-, HSO_4^-

(3) NH_3, HCO_3^-, HSO_4^-

(4) H_2O, HCO_3^-, HSO_4^-, NH_3

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	1	4	2	2	1	4	1	2	3	2	1	1	1	2	1
Question	16	17	18	19	20										
Answer	4	3	2	1	4										

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Important Notes